Joint

[Second Edition.]

PATENT SPECIFICATION

Application Date: June 12, 1926. No. 2,871 / 27. **268,271**

(Patent of Addition to No. 255,033. Convention Date (Italy): July 11, 1925.)

Complete Accepted: March 31, 1927.

COMPLETE SPECIFICATION.

Improvements in or relating to Joints for High Tension Electric Cables.

We, PIRELLI & C., a company incorporated under the laws of Italy, of Bicocca Works, near Milan, Italy, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to joints for electric cables which are designed to carry very high voltage currents and consists in an improvement in or modification of the joint for oil-filled high tension electric cables claimed in our prior Specification No. 255,033. The joint according to our said prior specification comprises in combination a pair of cable sections to be jointed, a pair of conducting blocks, each of the said blocks being formed with an inner socket to receive the bare end of a cable section and with an outer socket substantially concentric with the inner one, a pair of tubes made of insulating material each of the said tubes being fitted over the end of a cable section and being mounted in the outer socket in the corresponding block and a conductor electrically connecting the said blocks together, the arrangement of the parts being such that the cable section in the one block is shut off from communication with the cable section in the other block so far as concerns the passage of oil. In the construction mentioned the conducting blocks are preferably electrically connected together by a flexible conductor so as to permit of relative movement between them.

The present invention has for its object to provide an improved construction of the joint of the kind mentioned above in order to obtain a connection of such character that the conductor can be readily inserted and withdrawn at will, whilst at the same time a good electrical connection between the high tension cable and its respective connecting block will be established when the conductor has been inserted into the block, and for this purpose according to the present invention there is provided for each of the cable sections to be jointed an expansible and contractible set of conductor bars in electrical connection with the bare end of each cable section and adapted to be inserted therewith in a releasable manner into the socket in its respective conducting block.

A further feature of the invention consists in the provision of restraining means associated with the movable conductor bars for holding them in a retracted position to permit of their insertion into their respective socket and means for forcing the conducting bars radially outwards into contact with the socket walls when released from the action of said restraining means. A convenient arrangement for this purpose consists of a cage fitted around each set of conductor bars to hold them releasably in a retracted position and means for yieldingly forcing the bars radially outwards into contact with the walls of the socket when released from the action of the cage, said cage comprising upper and lower rings and a series of vertical elements connecting the rings and spaced from one another so as to allow the contact bars to fit between them.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings, in which:—

Figure 1 is a vertical section of a joint in which the conductors are inclined at an angle to each other,

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Figure 2 is an enlarged sectional view of the upper portion of the joint shown in Figure 1,

Figure 3 is a similar view of the lower portion of the joint, and

Figures 4 and 5 are detailed views of parts of the joint.

Referring firstly to Figure 1, 18 represents a cast iron box within which is a thin-walled lead casing 19 comprising a base portion and a cover, which are united by a wiped joint 20. The box is provided with a removable bronze cover 21, upon which the conductors and their connecting parts are supported, the purpose of making the box and cover of dissimilar metals being to reduce eddy current losses. The cover portion of the inner lead casing 19 is also supported by the box cover 21 so that it and the other parts can be removed from the box as a unit. Prior to sealing of the inner casing, the various parts of the joint, the details of which will be hereinafter described, are carefully wound with tape (the outline of the tape being indicated by dotted lines), care being exercised to have the tape tightly wound over the parts and to prevent any moisture from the hands of the jointer or otherwise from getting between the layers of tape.

The blocks 10 in which the cable ends are seated are connected electrically by the flexible connector 11. By making the blocks separate and uniting them by a flexible connector, each block is capable of slight movement with respect to the other, thus preventing any strain on the insulating tubes 12 hereinafter referred to which might cause them to crack.

Referring now to Figures 2 to 5, 18 indicates the lead sheath of the cable and 9 the factory-wound insulation, paper for example. In the cover 21 of the box is a socket 22 in which is mounted a sleeve 23 that is soldered thereto, the upper end of the sleeve being flared outwardly. Inside this sleeve fits the lower portion of the thimble 15, which latter is flared outwardly at its upper end and is connected to the lead sheath of the cable by a wiped joint 24, the joint between the sleeve and thimble being similarly formed.

The lead sheath having been cut away to expose the factory insulation 9, a tightly-wound paper tube 25 having a bevelled upper end is slipped over it. Surrounding the said tube end, the factory insulation and the lower end of the sheath is a metal funnel 26 (see Figure 5) made in two parts having companion ears 27 to receive clamping screws, the purpose of the funnel being to diminish the longitudinal electrical stresses at this point. A porcelain or other insulating tube 12 has its ends fitted in recesses or sockets, the upper end in a socket 22^1 on the underside of the box cover 21 and the lower end in a socket 22^2 formed in the connecting block 10 (see Figures 1 and 3). The tube and the walls of the sockets are provided with a series of grooves, parallel or otherwise, and these grooves and the space between the parts are filled with cement 28.

As previously mentioned it is necessary to establish good electrical connection between the high tension cable and the connecting block or member 10, and it is also necessary to have a connection of such character that the conductor can be readily inserted and removed at will. This is effected by means of the construction shown in Figure 3, in which the conductor comprises a central metal core 30 made after the fashion of a coiled spring and surrounded by the strands 31 of the conductor which are made of relatively small wires and outside of which is the factory insulation. Inside the conductor and engaging the core is a copper tube 32 which is soldered to the strands 31, the purpose being to support the strands from the inside, hold the end of the core in place and also afford for the oil which is contained in the cable a free passage to and from the chambers that surround the various parts of the joint.

In preparing the connection, the insulation is removed from the end of the conductor, and over it is slipped a relatively-long sleeve or tube 33 which is soldered to the wires or strands 31. The tube has a shoulder 34 at the top and a smaller shoulder 35 at the bottom, and between these shoulders is a plurality of radially-movable contact bars 36 each connected to the upper shoulder 34 by an elastic connector 37 which carries the current. As shown, the connectors 37 are composed of thin strips of conducting material such as copper, and they also act as springs to force the bars outwardly and in addition, each bar 36 is pressed outwardly by one or more leaf springs 38.

In order to facilitate the introduction of the spring-pressed contact bars 36 into the inner or lower socket 39 formed in the connecting block or member 10, it is necessary to provide a means to restrain said bars against the action of the spring connectors 37 and the leaf springs 38. Such a means is formed by the cage-like element shown in Figures 3 and 4 and comprising an upper flat ring 40, a lower ring 41 and vertical elements 42 which are situated between the contact bars 36 (as best shown in Figure 3), the vertical elements 42 being rigidly connected to the rings 40 and 41. When in the posi-

tion shown in Figure 3, the ring 41 holds the lower ends of the contact bars against the action of the springs, but when the parts are relatively displaced the ring moves into the notches 43 in said bars, thereby releasing the springs, as will appear later.

Prior to inserting the cable end into the socket 39, the cage is so adjusted that the ring 40 and 41 hold the contact bars 36 at the top and bottom, the springs being under greater than normal compression with the result that the diameter of the circle defined by the bars is less than the diameter of said socket. Under these conditions, the cable end can easily be slipped into place. The next step is to cause the cage to release the contact bars and permit them to engage the wall of the socket 39, and to accomplish this, the space between the shoulders 34 and 35 of the sleeve 33 is made slightly greater than the length of the cage, so that when the cable end is pressed downward, the upper ring 40 of the cage will engage the upper end of the socket. This causes the upper ring to release the bars and they move outwardly due to the action of the springs. The same action causes the lower ring 41 to move into the notches 43, whereupon the bars 36 will be pressed into contact with the wall of the socket throughout their length. In removing the cable end, it is only necessary to pull it out, the contact bars sliding on the wall of the socket. To replace the cable end, the cage is adjusted to again confine the bars as previously described.

The casings are filled with oil under suitable pressure, as are also the chambers or spaces between the insulating tubes and the various parts of the joint. This oil may be supplied from the centre passage in the conductor, which is itself supplied from a reservoir, to the interior of the joint. In any event, the oil which is contained in one cable section is prevented from flowing into the other. This is important because one cable section may be higher than the other, and without some means for stopping the flow of oil one section might wholly or partially drain another section, thereby causing a breakdown of the insulation.

It is to be understood that the arrangement of parts comprising the joint according to the present invention, although particularly described and illustrated in the foregoing description with reference to a construction where the conductors are inclined to each other, is of course also applicable to joints in which the conductors are not so inclined to one another but are in axial alignment.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An improvement in or modification of the joint for oil-filled high tension electric cables claimed in our prior Specification No. 255,033, in which there is provided for each of the cable sections to be jointed an expansible and contractible set of conductors bars in electrical connection with the bare end of each cable section and adapted to be inserted therewith in a releasable manner into the socket in its respective conducting block.

2. An improvement in or modification of the joint for oil-filled high tension electric cables claimed in our prior Specification No. 255,033, in which there are provided for each of the cable sections to be jointed a set of movable conductor bars in electrical connection with the bare end of each cable section and adapted to be inserted therewith into the socket in its respective conducting block and means associated with said bars for yieldingly forcing them radially outwards into contact with the walls of the socket in the conducting block.

3. A joint for oil-filled high tension electric cables as in Claim 1 or 2, in which there are provided restraining means associated with the movable conductor bars for holding them in a retracted position to permit of their inserted into their respective socket and means for forcing the conductor bars radially outwards into contact with the socket walls when released from the action of said restraining means.

4. A joint for oil-filled high tension electric cables as in Claim 1, 2 or 3, in which there is provided a cage fitting around each set of conductor bars to hold them releasably in a retracted position and means for yieldingly forcing the bars radially outwards into contact with the walls of the socket when released from the action of the cage.

5. A joint for oil filled high tension electric cables as in Claim 4, in which the cage comprises upper and lower rings and a series of vertical elements connecting the rings and spaced from one another so as to allow the contact bars to fit between them.

6. A joint for oil-filled high tension electric cables as in Claim 5, in which the conductor bars are provided with notches located a short distance above their lower ends with which notches the lower ring comes into engagement when the conductor bars are released from the upper ring and forced radially outwards

upon the occurrence of relative movement between the said bars and upper ring.

7. A joint for oil-filled high tension electric cables as in Claim 1, 2, 3, 4, or 5, in which a conducting tube having spaced upper and lower circumferential shoulders is secured to the bare end of each cable section and the movable conductor bars are carried by the said tube between the shoulders thereon.

8. A joint for oil-filled high tension electric cables as in Claim 1, 2, 3, 4, 5 or 6, in which a wrapping of insulating tape is wound round both the conducting blocks and their connecting insulating tubes and the parts so wrapped are enclosed in a casing.

9. A joint for oil-filled high tension electric cables as in any of the preceding claims, in which the conducting blocks are contained in a casing provided with a cover having a pair of sockets through which the cable sections project, a sleev fitting over and jointed to the projecting portion of each cable section being mounted in each of the sockets in said cover.

10. A joint for oil-filled high tension electric cables as in Claim 9, in which the under face of the cover of the casing is provided with a pair of sockets to receive the upper ends of the insulating tubes which fit over the end of each cable section.

11. A joint for oil-filled high tension electric cables substantially as described with reference to the accompanying drawings.

Dated this 1st day of February, 1927.

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2nd Edition

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

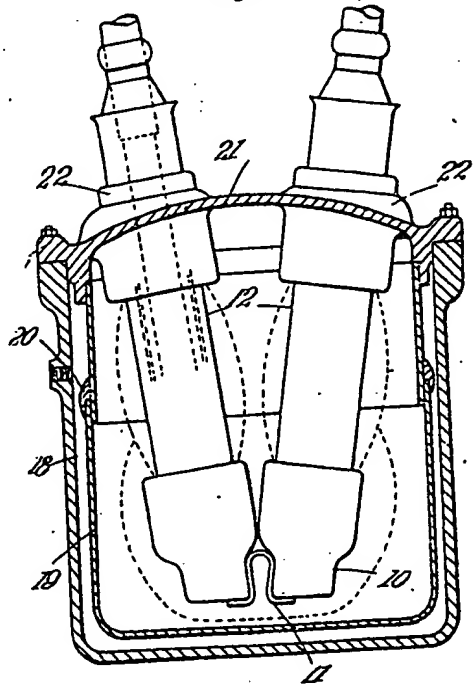


Fig. 2.

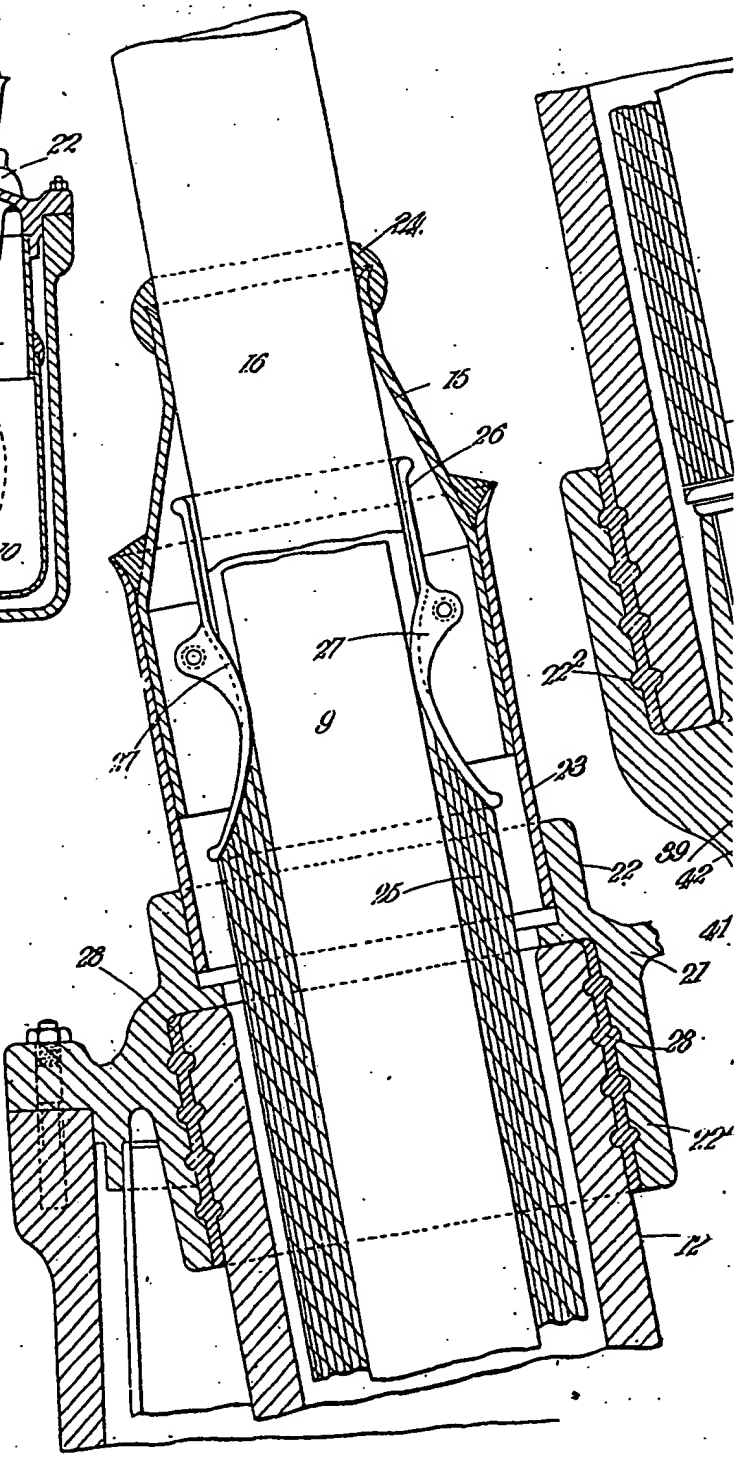


Fig. 4.

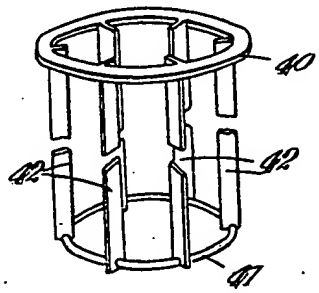


Fig. 6.

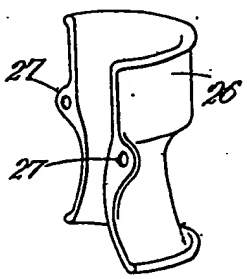
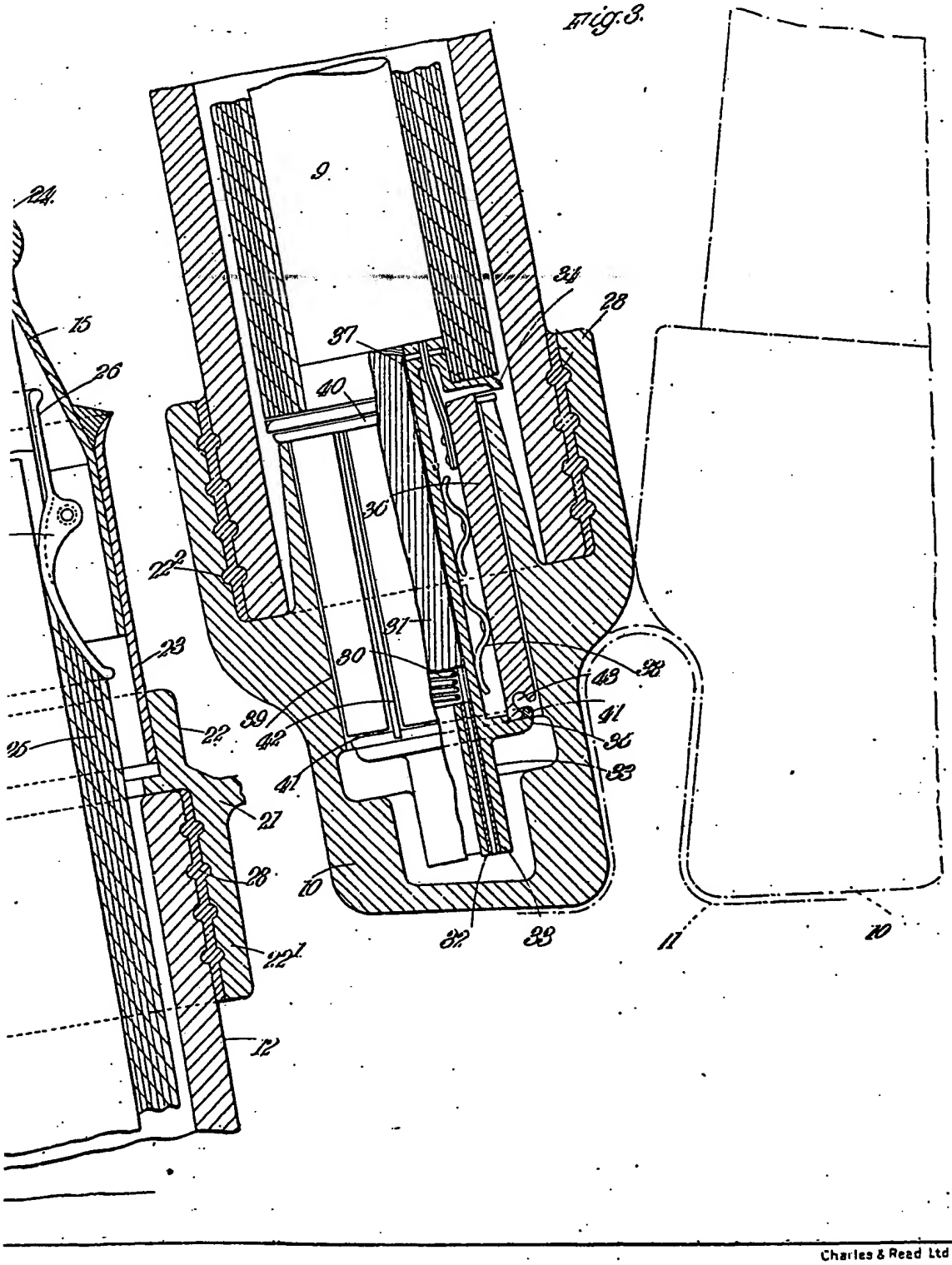


Fig. 3.



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268,271 COMPLETE SPECIFICATION

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[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

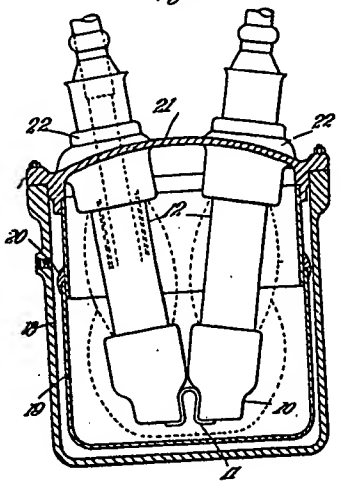


Fig. 2.

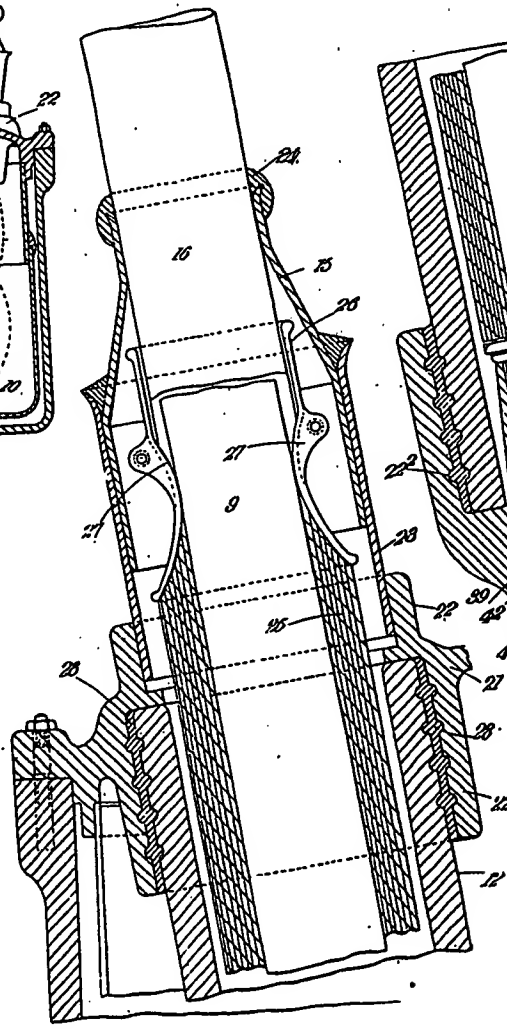


Fig. 3.

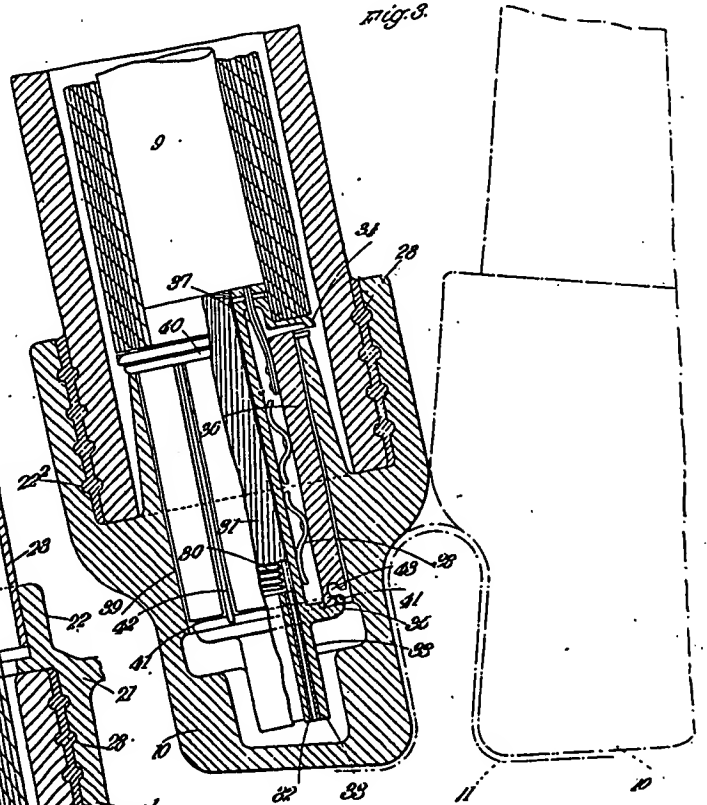


Fig. 4.

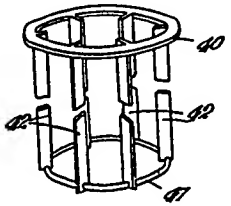
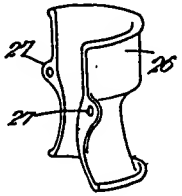


Fig. 6.



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